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STOCK ASSESSMENT OF NORTHERN PIKE IN THE VICINITY OF THE YUKON RIVER HAUL ROAD CROSSING, 1988 AND 1989[1]

By

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ABSTRACT

Northern pike *Esox lucius* were studied during the summers of 1988 and 1989 to determine whether harvests were sustainable in the Dall River. In the summer of 1988, 1,827 northern pike were sampled and tagged in streams located in the vicinity of the Yukon Haul Road Bridge: Dall River (964), Little Dall River (276), Old Lost Creek (437), Ray River (55), Hess Creek (78), and miscellaneous Yukon River locations (17). Northern pike longer than 250 millimeters fork length were marked with a numbered, external anchor tag. In July and August, 1989, 906 northern pike were captured, sampled, tagged, and released in the lower 18 km of the Dall River. Immigration of fish tagged in 1988 and recaptured in 1989 in the Dall River showed that northern pike in that river are part of a larger population extending beyond the Dall River. Because of this immigration, the estimated abundance of 4,385 northern pike in the lower 18 km in 1988 is probably biased high. Northern pike ages 5 through 9 were most frequent in all streams sampled and the oldest individual encountered was an estimated 17 years. Age composition of northern pike in the Little Dall River was skewed toward the younger age classes in comparison with samples from the Dall River and Old Lost Creek. Female northern pike were more abundant in the larger size classes than males. Growth rate of northern pike in the Dall River was faster than in the other streams measured in this study, and faster than in all other stocks measured to date in interior Alaska.

A partial angler survey conducted in 1988 in the Dall River in which 58 individuals were contacted, revealed that 76 northern pike were harvested by these fishermen. An expanded sport harvest estimate for either season is not available.

KEY WORDS: northern pike, *Esox lucius*, mark-recapture, age, sex and size composition, growth, Relative Stock Density, Dalton Highway, Yukon Haul Road.

INTRODUCTION

Northern pike *Esox lucius* are the second-most sought after fish species in interior Alaska (Holmes 1987). The sport harvest of northern pike in Alaska has averaged 18,771 fish annually between 1979 and 1988, with a high proportion (about 86%) of the statewide harvest being taken in interior Alaska (Mills 1980-1988). The sport harvest of northern pike from the area of the south slope of the Brooks Range, of which the study area is a part, averaged 466 fish between 1977 and 1983, but increased to 2,138 fish between 1984 and 1988 (Mills 1979-1988).

The Haul Road (Dalton Highway) to Alaska's North Slope and its bridge at the Yukon River were completed in 1973. Completion of the road and the bridge with its small boat launching ramp provided a means of access for urban recreational hunters and anglers to the middle Yukon River and its tributaries, including the extensive wetlands associated with the western Yukon Flats, between Fort Yukon and Stevens Village. Prior to road development, few people from outside the area visited for the purpose of sport fishing. Local residents of the nearby villages of Rampart, Stevens Village, and Beaver had almost exclusive use of fisheries resources, primarily for subsistence purposes. Harvest of local fish resources, especially in the areas closest to the bridge, has increased because of the influx of new users. However, the extent and intensity of this use has not been measured. The primary sport fisheries in the area are for northern pike, inconnu (sheefish) *Stenodus leucichthys*, and Arctic grayling *Thymallus arcticus* in tributaries and sloughs of the Yukon River and in nearby lakes.

Stevens Village residents petitioned the Alaska Department of Fish and Game (ADF&G) and the Alaska Board of Fisheries (ABF) in 1987 to reduce or eliminate the Dall River sport fishery on the grounds that increased visitor use had serious negative impacts upon both fish stocks and private land bordering the river. Traditional subsistence activities take place in the Dall River and it is also the stream most frequently visited by sport anglers entering the area via the Haul Road. Stevens Village residents asserted that non-local sport anglers have damaged private property on the lower Dall River and have depleted stocks of northern pike in streams near the Dalton Highway Bridge. Limited responses to statewide harvest surveys in 1979, 1984, 1985, 1986 and 1988 indicate that the sport harvest of northern pike in the Dall River has ranged from zero (1979) to as high as 1,750 (1984) (Mills pers. comm.)[1]. The estimated sport harvest of northern pike in the Dall River in 1988 was 418 fish (Mills pers. comm.)[1].

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Sumida (1988) in a comprehensive study of subsistence use patterns in Stevens Village, reported that 730 northern pike were harvested for subsistence by residents of Stevens Village in 1984. This subsistence harvest occurs primarily in Old Lost Creek, Dall River, Little Dall River, Jackson Slough and the Yukon River slough immediately adjacent to Stevens Village. The proportion of this harvest taken from the Dall River was not reported by Sumida (1988). While this study has not attempted to document subsistence harvest, information gathered from local residents suggests that although the Dall River drainage is used for subsistence activities, a significant proportion (probably the majority) of northern pike harvested for subsistence is taken from areas other than the Dall River.

In December 1987, the ABF placed a daily bag and possession limit of five northern pike (only one longer than 760 mm or 30 inches) for that part of the Yukon River drainage from the mouth of the Tanana River upstream to and including the Hodzana River drainage. Prior to this action, there had been no bag limit for northern pike in these areas. The ABF action should reduce the annual harvest of northern pike. An identical bag limit regulation was enacted for the Tanana River drainage at the same time.

Study Objectives

The goal of this project was to determine whether the estimated annual harvest of northern pike from the Dall River is sustainable. Populations were surveyed within the Dall River and adjacent watersheds to estimate abundance, and age and size composition of northern pike in the Dall River and nearby streams to provide a basis for determining sustainable yields and to define the composition of the local stocks.

The study was scheduled for a minimum of two years duration, with analysis of stock definition and abundance scheduled for the second year (1989). Project objectives for the 1989 field season were to:

1. test the hypothesis that the population of northern pike in the Dall River is closed[2];

2. estimate the abundance of northern pike in the Dall River;

3. estimate the sex and age compositions of the population(s) of northern pike in and outside the Dall River;

4. estimate the mean length of northern pike in and outside the Dall River, and in the subsistence and sport harvest; and,

5. estimate the parameters in the age-length relationship for northern pike in the Dall River.

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[2] A population has been arbitrarily defined as geographically closed if no more than 5% of its population is composed of new immigrants.

Because little information on the number of anglers using this area was available, sport anglers were interviewed to test the feasibility of conducting an intensive harvest survey, and of obtaining accurate and precise estimates on the demography, preferences, and harvest rates of anglers.

Results of the 1988 phase of the study have been published (Arvey and DeCicco 1989). Most of the 1988 results are reprinted here with the inclusion of 1989 data. This report is intended to serve as a completion report for both years of study.

Study Area

The Yukon River and its tributaries in the vicinity of the Dalton Highway (Figure 1) include an area which encompasses the drainages of Hess Creek, Ray River, Little Dall River, Dall River, Alfred Creek, and Old Lost Creek. Geographic details of the study area and land ownership status may be found in Appendix A7.

A feature of significance to this study is that the Dall River and the Little Dall River drainages interconnect approximately 70 km upstream from the mouth via two channels (Figure 2). The cross drainage allows the exchange of water between the two systems and the potential for interchange of fish populations at least during higher water stages.

A log jam located approximately 26 km upstream completely blocked the Dall River to boat travel in 1988 and no sampling was conducted above that point. The Little Dall River was not sampled in 1989. Old Lost Creek was sampled in 1988 but not in 1989.

MATERIALS AND METHODS

Fish Capture

Fish were sampled in tributaries that flow into three sections of the Yukon River: (1) between the Tanana River confluence and the Dall River, (2) the Dall River and its tributaries, and (3) between the Dall and Hodzana Rivers. In the first section, northern pike in the Little Dall River, Ray River, and Hess Creek were captured. Fish in the Dall River were sampled in the second section. In the third section, sampling occurred in Old Lost Creek. Sampling in 1989 was conducted only in the Dall River.

Floating and sinking, variable mesh gill nets were the primary gear used to capture northern pike throughout the study area. Other capture methods included hook and line, baited and unbaited hoop and fyke nets, and electrofishing. Gill nets were of two types:

1) floating nets, 38 m long with five 7.6 m panels of 25, 38, 51, 64, and 76 mm bar mesh multifilament netting; and,

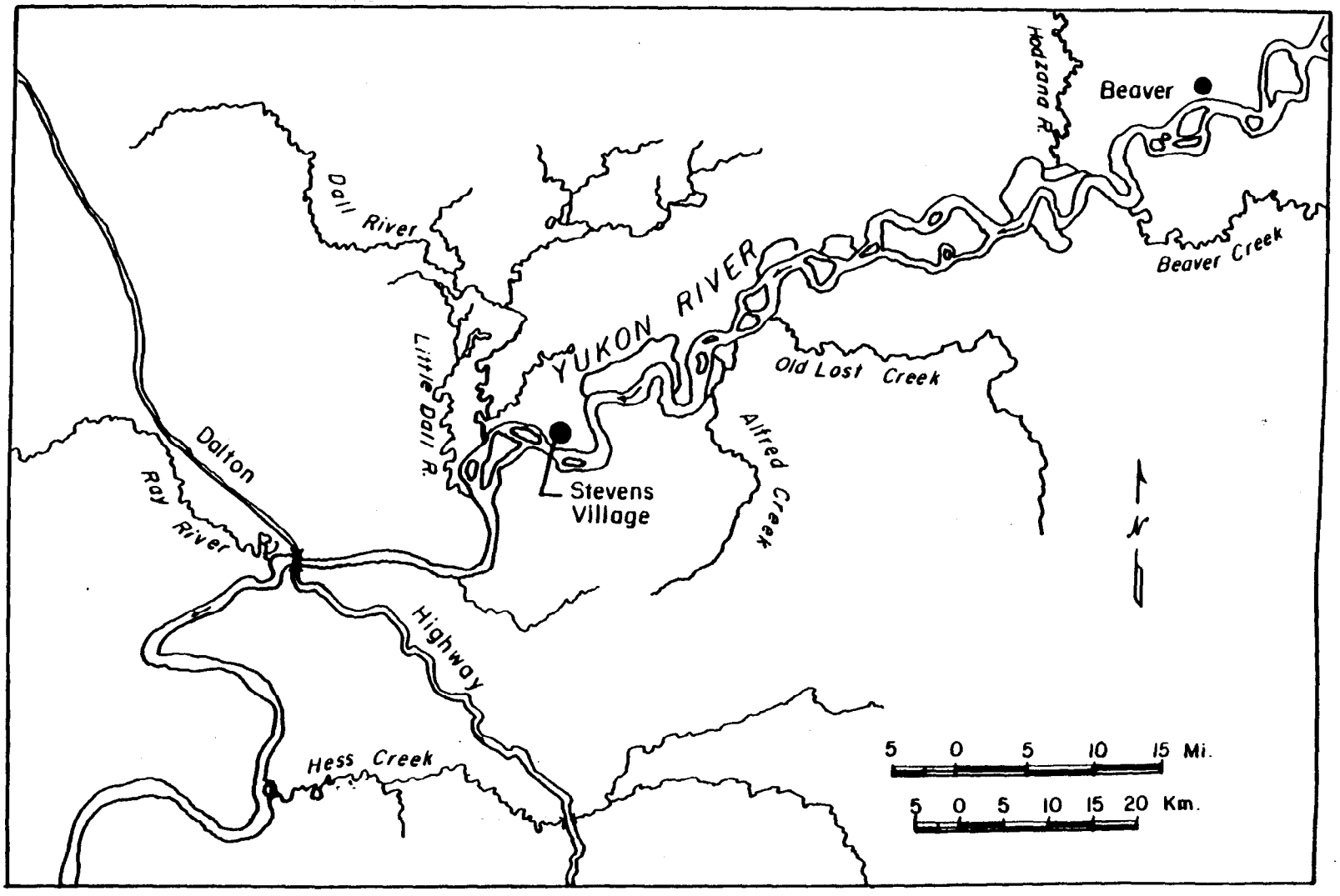

Figure 1. Yukon River drainage from Beaver to Hess Creek.

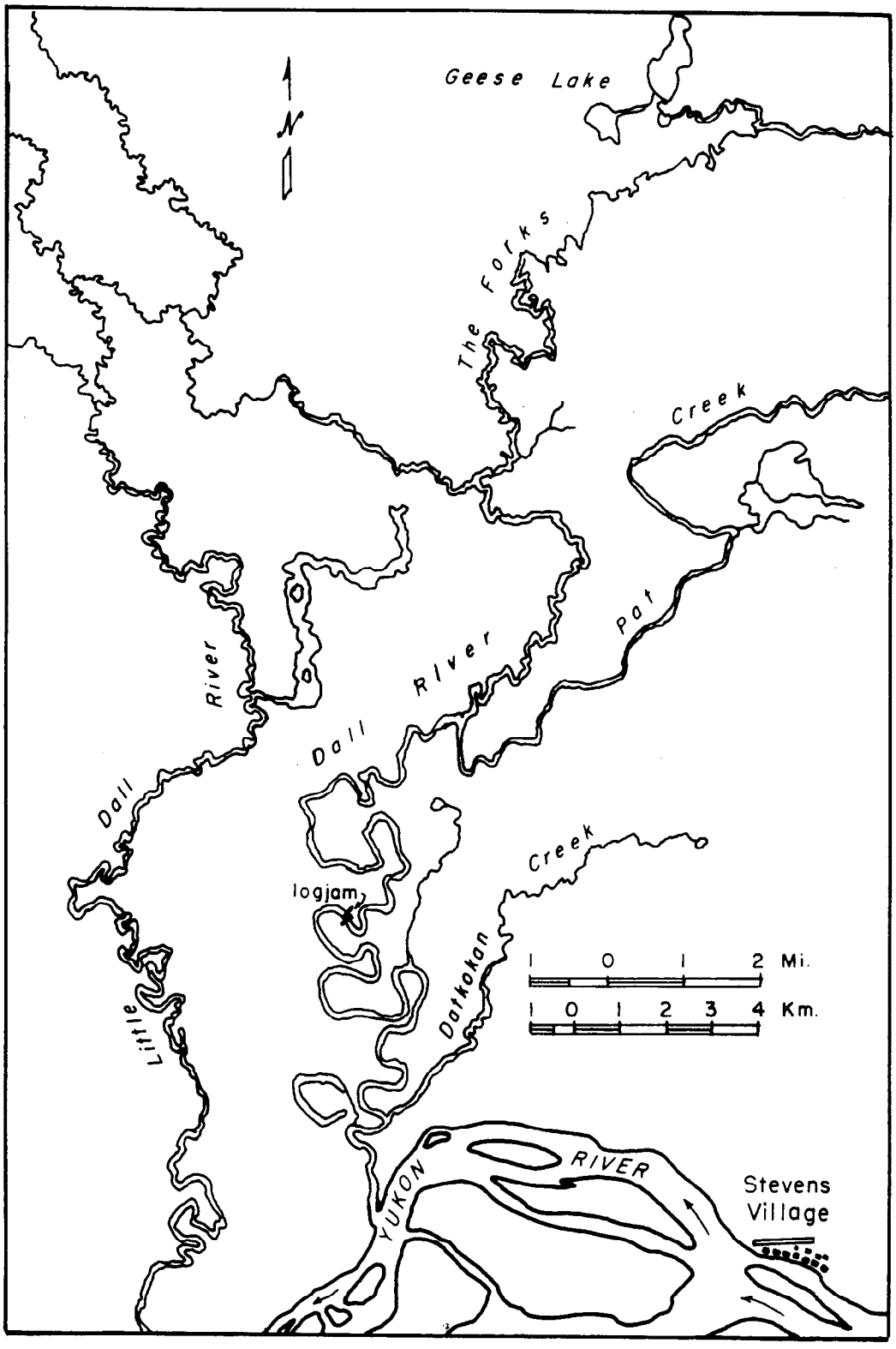

Figure 2. Lower portions of the Dall River and Little Dall River drainages, western Yukon Flats.

2) sinking and floating nets, 46 m long with six 7.6 m panels of 25, 38, 51, 25, 38, and 51 mm bar mesh multifilament netting.

Hoop traps were 1 m in diameter by 4 m long with 25 mm square mesh nylon netting on seven fiberglass hoops. Hoop traps had finger-style throats on the second and fourth hoops. Attached leads and wings were of various lengths up to 10 m and depths up to 1.3 m with mesh sizes of from 25 mm to 64 mm. Fyke traps used were 1.2 m square at the mouth, with leads of various lengths to shore. Leads to the fyke traps spanned the entire stream or slough width where fished.

Field work in 1988 commenced on 6 June and continued through 24 August during which time a crew of three to four persons was present for six, 10 day periods in the study area. Streams in the study area were accessed with 4.9 m and 5.5 m flat-bottom river skiffs equipped with outboard motors. Sampling in 1989 continued on a 10 day on, four day off basis from 18 July through 30 August.

General procedures during each 10-day sample period were to first install up to 12 hoop nets and two fyke nets throughout the area to be sampled. Hoop nets were sometimes baited if fished singly without leads, or left unbaited if used with net leads. Several double sets were made, consisting of two hoop nets set back-to-back near shore, with mouths oriented up- and downstream respectively. Leads were installed from the mouth of the hoop towards midstream to guide fish moving along shore to the net mouth. Many of the nets were set singly, near shore, without leads and with or without bait. Nets, once set, were usually kept at the same fishing location for the duration of the sampling period. Hoop and fyke nets were checked once every 12 hours.

Following installation of hoop and fyke nets, several gill nets were set in the area to be sampled. Two sets of gill nets were monitored by either two or three person crews. During extremely slow sampling periods, with catch rates less than one fish per net hour, up to six gill nets were fished, and as few as a single net was fished during periods of high catch rates (> 10 fish/net hour). Because of the limited size of the waterways fished during the study, gill nets were usually tied off on shore, shortening the length of net actually fished by 25% to 50% of the total net length. Gill nets were set from shore perpendicular to the current direction, generally in shallow (less than 2 m) water. Current velocity of all sampling locations was less than 0.5 m/sec. Gill nets were fished from six to 13 hours each sampling day. Nets were checked after every 30 minutes to one hour of fishing time to minimize capture-induced sampling mortality.

Northern pike were tagged with individually-numbered Floy FD-68 anchor tags placed near the insertion of the interneural rays of the dorsal fin. Northern pike captured in different parts of the study area in 1988 were fin marked to both minimize bias due to tag loss and to allow rapid determination of initial tagging location. The left pectoral fin was partially removed from fish caught in the first study section, the right pectoral fin was clipped from fish caught in the second section, and the left pelvic fin was clipped from fish caught in the third section.

Set and lift times were recorded for each net, and locations of all nets were sequentially numbered and recorded on maps. A separate map was used for each day.

Boat-mounted electrofishing techniques using pulsed DC current were attempted on several occasions in 1988 and once in 1989. Few fish were captured for the effort expended.

Age, Sex, and Length

Each captured northern pike was measured to the nearest mm of fork length (FL), and examined to determine sex according to methods described by Casselman (1974). Sex determination was not made in 1989 after determination of sex in post-spawning northern pike was found to be problematic.

Scales for determination of age were removed from each live fish, and scales, vertebrae (cervical), and cleithra were taken from each dead fish. All mortalities were dissected to verify sex and maturity by examination of the gonads. Scales were stored in coin envelopes and later removed, cleaned, and mounted (two per fish) on gum cards. Gum cards were used to make scale impressions on 20 mil acetate using a Carver press at 137,895 kPa (20,000 psi) heated to 93°C for 30 seconds. Ages were estimated from examining the scale impressions on a 3M Consultant Microfiche reader and counting annular growth checks.

Age and sex composition was calculated for northern pike populations residing in each of the five streams sampled in the study area. Data were not stratified by time period. The percent age composition and associated variances were estimated as multinomial proportions using the following formulas (Cochran 1977):

$$\hat{p}_i = \frac{n_i}{n}; \qquad (1)$$

$$\hat{V}[p_i] = \frac{\hat{p}_i(1-\hat{p}_i)}{n-1}; \qquad (2)$$

where:

$\hat{p}_i$ = the proportion of fish of age i in the sample;

n_i = the number of fish of age i in the sample; and,

n = the number of fish in the sample.

Minimum length categories for Relative Stock Density (RSD) were defined after review of Gabelhouse (1984). The RSD estimates were calculated as the percent of all northern pike 300 mm FL and longer within a defined length category.

Growth characteristics by stock were estimated with length-at-age data. The von Bertalanfy growth model (Ricker 1975) was chosen to calculate absolute growth at ages 1 through 14 years. Model parameters were the theoretical maximum length (L_∞), the Brody growth coefficient (K), and the theoretical length at age 0 (t_0). Using data from 1988, these parameters were fitted by nonlinear regression with the Marquardt compromise (Marquardt 1963). The range of parameter values chosen for iteration by the model were L_∞: 400 to 1,200 mm by 200 mm increments; K: 0 to 0.4 by 0.1 increments; and t_0: -2.0 to 2.0 mm by 0.5 mm increments.

In 1989, length measurements of recaptured northern pike were used to estimate the parameters of the von Bertalanfy model of growth for males and for females. The differential form of this model is:

$$\frac{dl}{dt} = K(L_\infty - l_t) \qquad (3)$$

where:

K and L_∞ are defined above; and,
l_t = the length of a northern pike at time t.

Equation (3) was approximated as per Jain (1984):

$$l_{t+\Delta_t} - l_t \approx \exp[\Delta t\{K(L_\infty - l_t)\}] \qquad (4)$$

where:

Δt is the change in time in days.

In turn, Equation (4) was transformed, and defined for individual fish:

$$\frac{\mathrm{Log}_e \Delta l_j}{\Delta t} \approx KL_\infty - Kl_{t,j} + e_j \qquad (5)$$

where:

e_j is the deviation of the j^{th} northern pike from the norm.

Under the model in equation 5, the parameters K and L_∞ were estimated through least-squares regression. Bootstrap methods of Efron (1982) were used to estimate the variance and covariance of the parameters.

Geographic Closure of the Dall River Northern Pike Population

The population was arbitrarily defined as closed if no more than 5% of its members was composed of new immigrants. To test the hypothesis that the population of northern pike in the Dall River is geographically closed, the probability of a fish being tagged outside the Dall River, migrating to the Dall River and being caught there was calculated. In 1988, 863 fish were tagged outside the Dall River (Old Lost Creek, Little Dall River, Ray River, and Hess Creek) so that an estimated 647 individuals were still alive after discounting for an assumed 75% annual survival rate. If the abundance of fish in the Dall River in 1988 was 15,500 and if x of these fish are sampled in 1989, the probability of at least one fish tagged outside of the Dall River, migrating to the Dall River and being caught there is $x(0.05/15,500)$. Therefore for a 95% $(1-\alpha)$ chance of finding at least one immigrant in the Dall River under these conditions, it was necessary to inspect 1,425 fish per the following approach:

$$\alpha = \left[1 - \frac{x(0.05)}{15,500}\right]^{647} \qquad (6)$$

Sampling in 1989 was discontinued after sampling goals of the mark-recapture experiment had been met because several immigrants had been captured.

Dall River Abundance Estimate

To estimate population abundance of northern pike residing in the Dall River in 1988, a two-year, two sample mark-recapture experiment was used based on Chapman's (1951) modification of the Petersen estimate. Northern pike that were marked and released in 1988 constituted the first sample while fish captured during 1989 constituted the second. Since no prior information on the abundance of northern pike in the Dall River existed, the number of fish to be tagged in 1988, and the number of fish to be inspected in 1989 was based on an abundance that could sustain observed harvests.

Population abundance ($\hat{N}$) of northern pike in the Dall River was estimated as follows (Seber 1982):

$$\hat{N} = \frac{(C+1)(M+1)}{(R+1)} - 1; \text{ and,} \qquad (7)$$

Variances of the population estimate ($V[\hat{N}]$) were estimated as follows:

$$V[\hat{N}] = \frac{\hat{N}(C-R)(M-R)}{(R+1)(R+2)} \quad . \qquad (8)$$

where,

C is the number of fish captured in the second event;
M is the number of fish marked in the first event; and,
R is the number of fish recaptured in the second event.

Limited experience with stocks of northern pike in the Tanana River drainage, especially those in Volkmar Lake, has shown that annual yields of 16% from a stable population can be sustained[3]. The estimate of harvest of northern pike in subsistence and sport fisheries on the Dall River in 1984 was 2,480 (Mills pers. comm.[4]; Sumida 1988). Assuming that this level of harvest would be a maximum sustainable yield and that productivity of this population is similar to that of Volkmar Lake, approximately 15,500 northern pike should be present in the Dall River population. Sampling targets were based on this abundance with knowledge that if the real abundance were higher, the estimate would be less precise than desired, but observed yields would be sustainable.

The double marking of fish permitted corrections to be made for any bias in the estimate due to loss of tags. Assuming that mortality remained constant between marked and unmarked fish, an unbiased estimate germane to just prior to the first sampling event in 1988 was obtained.

Creel Survey

The following information was recorded during each angler interview in 1988:

1) Date and time of day;
2) Location (coded to individual stream and section of stream);
3) Number of anglers in party;
4) Time spent fishing and whether or not the trip was complete;
5) Number of fish by species kept and released;
6) Demography (sex, adult or youth, resident or non-resident, local or non-local, civilian or military, guided or unguided); and,
7) Gear (type of gear, type of boat, number of hooks, length of net, mesh size).

RESULTS

Sampling and Tagging

In 1988 1,827 northern pike were sampled and tagged: Dall River (964), Little Dall River (276), Old Lost Creek (437), Ray River (55), Hess Creek (78), and miscellaneous Yukon River (17). In 1989, 906 northern pike were captured,

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[3] Based on estimates of abundance and harvest of northern pike from Volkmar Lake (Mills 1987; Peckham 1986; Peckham and Bernard 1987).

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sampled and tagged from the Dall River (Table 1). In 1988, the majority, 1,330 (73%) of the fish, were captured by gill net, while hoop nets accounted for 385 (21%) fish, hook and line accounted for 108 (6%) fish and, fyke net and electrofishing methods accounted for only two fish (< 1%) each. In 1989, gill nets accounted for 729 (81%) of the fish captured, while 174 (19%) fish were captured with hoop nets. One fish was taken by hook and line and two were captured with electrofishing gear. Immediate sampling mortality in 1988 totaled 64 northern pike, 4.0% of all northern pike sampled, while in 1989, nine northern pike died as a result of sampling, 1% of the total number captured. All mortalities occurred in gill nets.

Age, Sex, and Length, 1988

Age composition of northern pike (combined sexes) in the Little Dall River was skewed toward the younger age classes compared to samples taken from the Dall River and Old Lost Creek in 1988 (Appendices A2 and A3). Estimated age distributions of northern pike (combined sexes) in 1988 differed significantly among northern pike stocks residing in Old Lost Creek, Ray/Hess/Little Dall, and Dall rivers (chi-square = 228.9, df = 20, $P < 0.001$).

Northern pike sampled from the Dall River attained the greatest length at a given age (age classes 3 through 10, Figure 3, Appendix A2). Of the remaining sampled stocks, sample sizes from Ray River and Hess Creek were too small to permit a meaningful comparison. Length frequency analysis (Appendices A2 and A5) indicates that the average size of northern pike in the Dall River and Old Lost Creek was larger and the distribution more normal than in the Little Dall River, Hess Creek and Ray River samples. Northern pike sampled from the Little Dall River were smaller in average fork length than those sampled from the Dall River and Old Lost Creek.

Relative Stock Density (RSD) analysis for 1988 and 1989 (Table 2) indicates that a higher proportion of the Dall River (in both 1988 and 1989) and Old Lost Creek northern pike (combined sexes) were in the "preferred" size range in contrast to the other sampled stocks where the fish were predominantly in the "quality" and "stock" size categories. Results from the Dall River in 1989 suggest that while the overall size distribution remained substantially the same from 1988 to 1989, greater numbers of stock size fish were represented in the 1989 sample (Table 2).

Length distributions of combined sexes in 1988 significantly differed among northern pike stocks in the Dall River and Old Lost Creek (chi-square = 29.4, df = 3, $P < 0.001$) and the Dall River and Ray/Hess/Little Dall Rivers (chi-square = 359.7, df = 3, $P < 0.001$). This analysis was not repeated in 1989 since only a single stock was sampled.

Theoretical maximum lengths (L_∞) for male and female northern pike in the Dall River in 1988 were 790 mm (SE = 37) and 1,082 mm (SE = 193), respectively. The Brody growth coefficients (K) for males and females was 0.19 (SE = 0.05) and 0.08 (SE = 0.04), respectively. The relationship between L_∞ and K appeared to be inverse. Theoretical age-at-length zero for males and females was -3.04 years (SE = 1.44) and -5.54 years (SE = 2.27), respectively

Table 1. Summary of northern pike tagged during 1988 and 1989.

Year/Location	Dates: June 6-15	June 20-29	July 5-13	July 18-31	August 1-10	August 11-24	Total
1988:							
Dall River	70	162	190	2	134	406	964
Little Dall River			276				276
Old Lost Creek				437			437
Ray River					55		55
Hess Creek					78		78
Misc. Yukon River				16		1	17
Subtotal:	70	162	466	455	267	407	1,827
1989:							
Dall River				464	251	191	906
Grand Total:	70	162	466	919	518	598	2,733

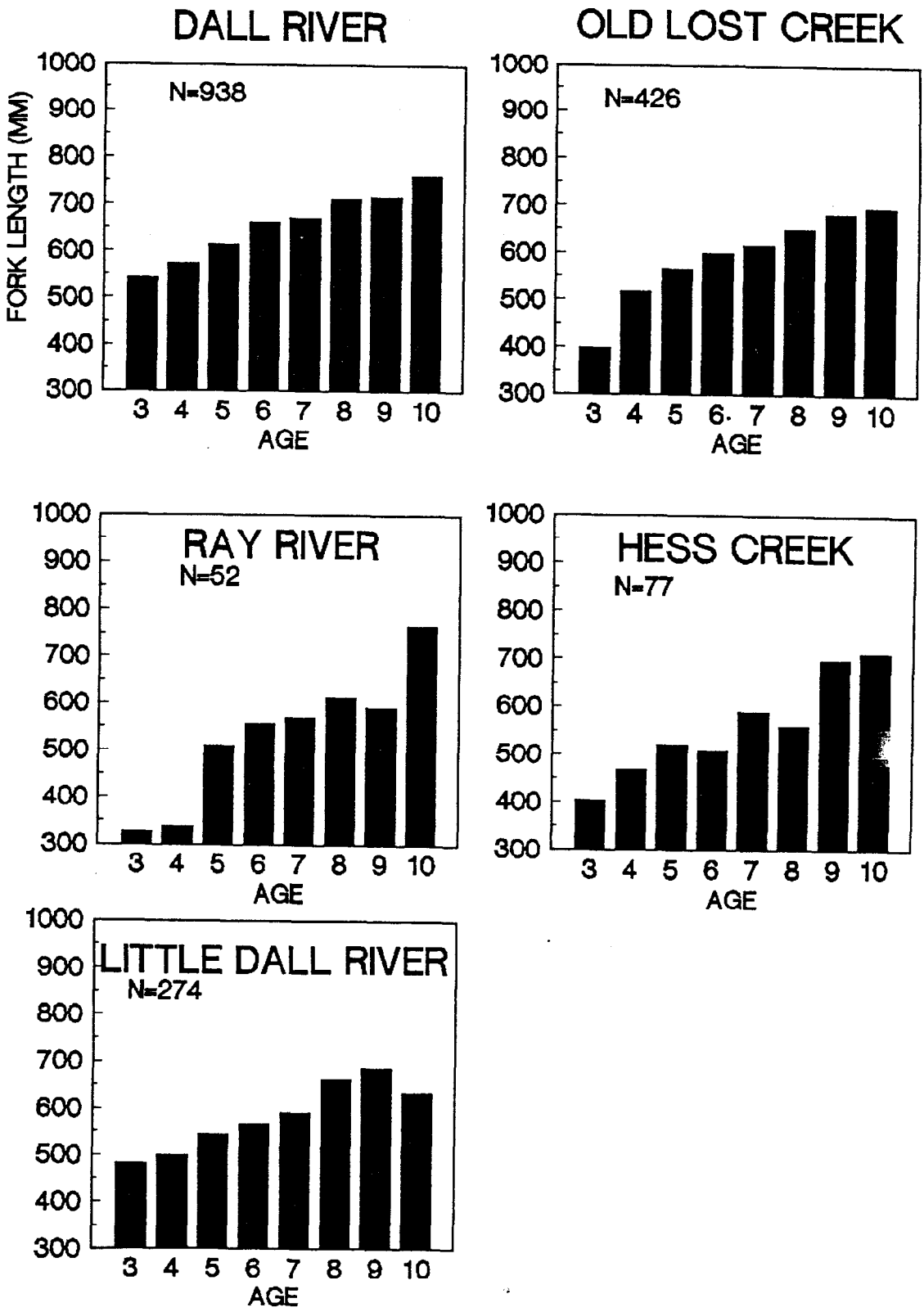

Figure 3. Mean length at age of northern pike captured in 1988.

Table 2. Length categorization of northern pike sampled in Yukon River tributaries, 1988 and 1989.

RSD Category	RSD[a] Length Range (mm)	Dall R. 1988		Dall R. 1989		Old Lost Cr. 1988		L. Dall R. 1988		Ray River 1988		Hess Creek 1988	
		n	% Sample	n	% Sample	n	% Sample	n	% Sample[c]	n	% Sample[c]	n	% Sample
Stock	300 to 524	41	4.0	137	15.3	32	7.0	111	40.4	14	25.0	22	29.7
Quality	525 to 654	394	41.0	314	35.1	228	52.0	130	47.2	29	51.8	33	44.6
Preferred	655 to 859	493	51.0	414	46.4	170	39.0	33	12.0	11	19.6	18	24.3
Memorable	860 to 1,079	36	4.0	29	3.2	8	2.0	1	0.4	2	3.6	1	1.4
Trophy	>1,079	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total		964	100.0	894	100.0	438	100.0	275	100.0	56	100.0	74	100.0

[a] Categories taken from Gabelhouse (1984).

(Table 3). Correlation between L_∞ and K was high for both sexes (Pearson correlation coefficient = -0.97 and -0.99 for males and females respectively).

Analysis of length-based data from northern pike recaptured in 1989 are included in Table 3. Theoretical maximum length (L_∞) for males and females in the Dall River during 1989 was 893 mm (SE = 58) and 1,060 mm (SE = 98) for males and females respectively. The Brody growth coefficients (K) for males and females was 0.20 (SE = 0.04) and 0.14 (SE = 0.03), respectively. Correlation between L_∞ and K was high for both sexes (Pearson correlation coefficient = 0.87 and - 0.91 for males and females, respectively).

Age and Length, 1989

Recapture and sampling efforts captured 906 northern pike in the Dall River in 1989.

Six and 7 year-old northern pike dominated the 1989 sample (Figure 4 and Appendices A2 and A4) and only 5% of the fish were estimated to be older than age 8. A larger proportion (37%) of northern pike were estimated to be older than age 8 in 1988 than in 1989.

Mean length at age through age 6 was smaller in 1989, and the mean length at age for fish older than age 6 is larger, than in the 1988 samples (Appendix A2). Length frequency distribution of Dall River northern pike samples in 1989 was very similar to that in 1988 (Figure 5), however it is evident that in 1989 the sample was composed of a substantially higher proportion of smaller fish (< 600 mm), an indication that recruitment had occurred.

Geographic Closure of the Dall River Northern Pike Population

The northern pike residing in this stream during sampling do not constitute a closed population. Thirty-eight northern pike tagged were recaptured in another drainage in 1988 and 1989 (Appendix A6). Most of the interchanges documented in 1988 from 1988 tag recoveries, were between the Little Dall and Dall rivers, but one recovery was in Hess Creek of a northern pike originally tagged in the Dall River 26 days earlier. Eight tags were recovered by Stevens Village fishing during the fall of 1988 in Jackson Slough, 3 km upstream of Stevens Village. All of these recaptures were from northern pike originally tagged in the Dall River.

Twenty-six northern pike were captured in the Dall River in 1989 that had been tagged outside of the Dall River in 1988. The majority (21) of tagged immigrants were originally marked in the Little Dall River, but four were marked in the Ray River and one in Hess Creek. Tagged immigrants from the Little Dall River comprised about 8% of the number originally tagged there in 1988, while comparable numbers from the Ray River and Hess Creek are 7% and 1%, respectively. A total of 163 (17%) of the northern pike tagged in the 1988 effort were recaptured in 1989. None of the 437 fish tagged in Old Lost Creek in 1988 were recovered in 1989.

Table 3. Parameter estimates of the von Bertalanffy growth equation for northern pike in Volkmar[a], George[b], and T lakes[c] and the Dall River by sex.

Sex	L_∞	SE L_∞	K	t_o	Correlation Coefficient L_∞/K
Volkmar Lake					
Females	1,079	52	0.12	-0.56	-0.98
Males	741	19	0.25	0.48	-0.95
George Lake					
Females	1,030	97	0.13	-1.00	-0.99
Males	971	242	0.09	-2.94	-0.99
T Lake					
Females	965	94	0.15	0.11	-0.98
Males	887	170	0.14	-0.20	-0.99
Dall River 1988					
Females	1,082	193	0.08	-5.54	-0.99
Males	790	37	0.19	-3.04	-0.97
Dall River 1989					
Females	1,060	98	0.14	-[d]-	-0.91
Males	893	58	0.20	-[d]-	0.87

[a] Pearse and Timmons 1989.
[b] Clark et al. 1988.
[c] Clark 1988.
[d] value not calculated in 1989

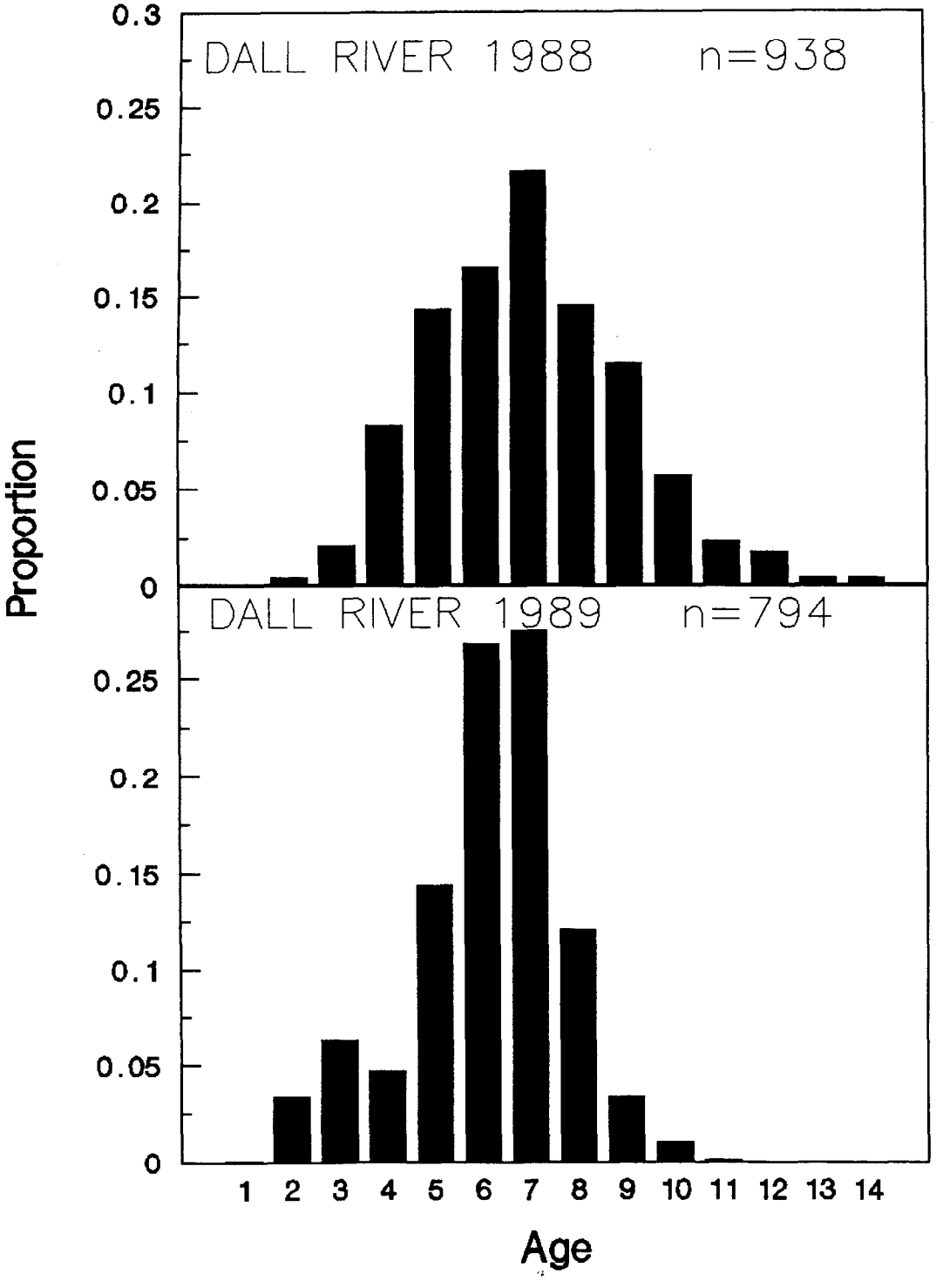

Figure 4. Age proportions of northern pike captured in 1988 and 1989 from the Dall River.

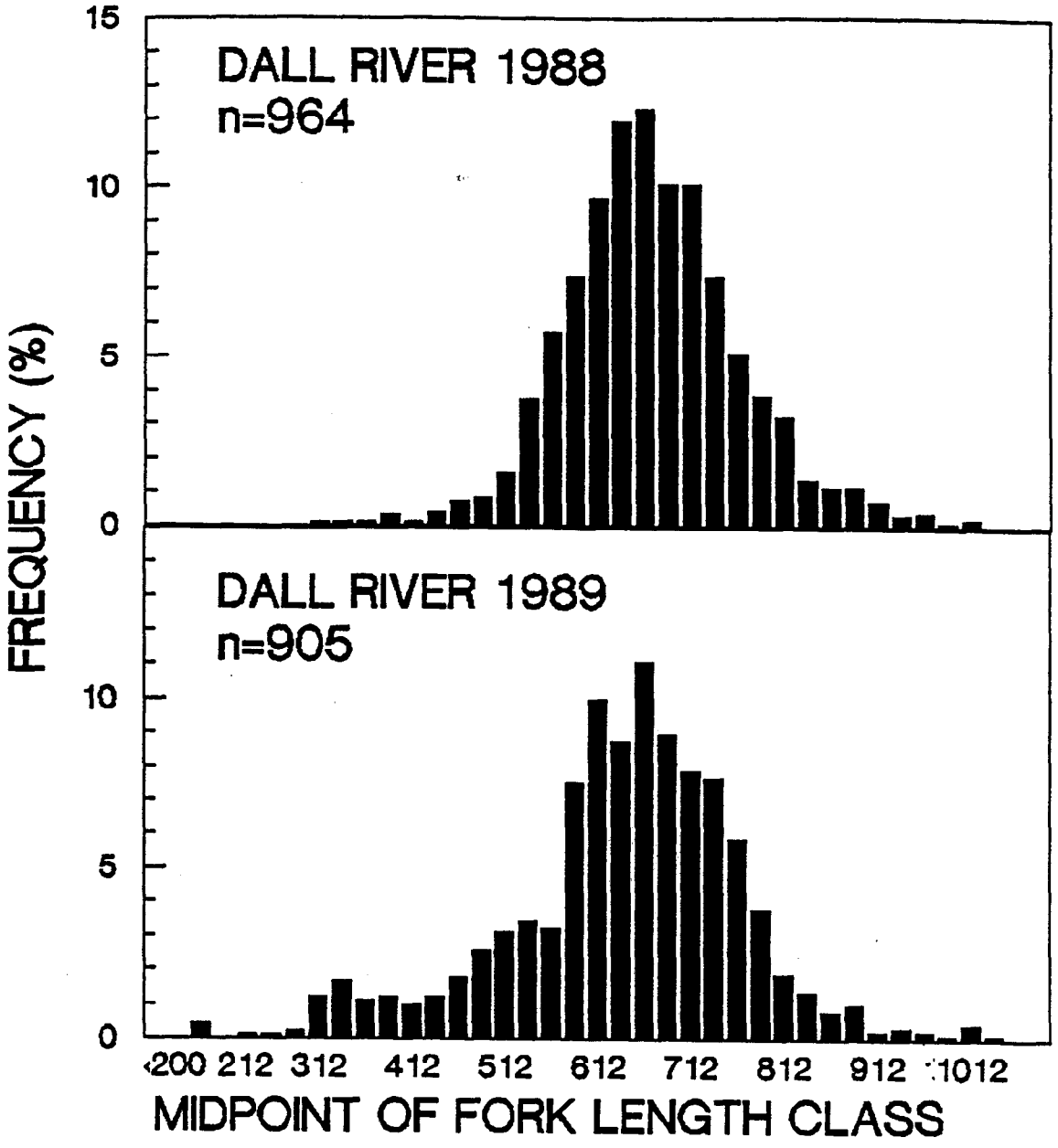

Figure 5. Length frequency distribution of northern pike captured in 1988 and 1989 in the Dall River.

Dall River Abundance Estimate

The number of northern pike greater than 299 mm fork length in the lower 18 km of the Dall River in June through August of 1988 was estimated at 4,385 fish (SE = 313). The ratio of marked to unmarked fish in the lower 18 km of the Dall River was higher than in the upper Dall River (χ^2 = 7.02, df = 1, 0.005 < P < 0.01). Differential recapture rates within the drainage suggest that an unrestricted population estimate would be biased because of incomplete mixing of marked and unmarked individuals. Therefore, the population estimate is calculated by including only recaptures of northern pike that were originally tagged in the lower Dall River. Growth recruitment was not culled from the estimate since it was not possible to separate this source of recruitment from that due to immigration. No fin clipped northern pike were captured with missing tags indicating that there was no significant tag loss during this study. Chi-square analysis of marked and recaptured fish by length category failed to reject the hypothesis of equal probabilities of capture for northern pike of all sizes (χ^2 = 2.86, df = 2, 0.01 < P < 0.25).

Creel Survey

Only a few anglers were interviewed in locations other than the Dall River. Therefore no attempt was made to summarize interview data from stream locations outside of the Dall River. Fifty-eight anglers were interviewed in the Dall River in 1988. The interviewed anglers reported keeping 76 northern pike from a total catch of 174 fish in 255 hours of fishing (Table 4). Lengths were obtained from 23 northern pike harvested in the sport fishery on the Dall River. The mean length of females was 768 mm (n = 11, range = 611 to 965 mm, SE = 117 mm) and for males was 696 mm (n = 12, range = 606 to 810 mm, SE = 64 mm).

By regulation, the Dall River is closed to subsistence fishing for northern pike from 10 June through 10 September. Since the data for this study were collected from June through August in both years, no subsistence harvest data were collected.

DISCUSSION

Age, Sex, and Length

Data collected during this study was compared to four other northern pike populations in interior Alaska for which data are available: T Lake (Clark 1988), Volkmar Lake (Clark and Gregory 1988), George Lake (Clark et al., 1988; Timmons and Pearse 1989) and Minto Flats (Holmes and Burkholder 1988). In general the other cited studies have shown that in larger and older size and age classes female northern pike were more abundant than males. The sex ratio of larger northern pike (> 750 mm) favors female fish for all Haul Road stocks measured except for Hess Creek where only a very small sample size was available in that size range. When the comparison is based upon age, female dominance of the older northern pike is not evident.

Table 4. Dall River angler surveys, 1988.

Date	No. of Anglers	Hours Fished	Northern Pike		Total Hours	CPUE	
			Caught	Kept		Caught	Kept
09 Jun	3	2.9	0	0	8.7	0.00	0.00
22 Jun	2	0.2	0	0	0.3	0.00	0.00
23 Jun	2	3.0	0	0	6.0	0.00	0.00
25 Jun	2	3.0	0	0	6.0	0.00	0.00
25 Jun	2	5.0	0	0	10.0	0.00	0.00
26 Jun	2	4.5	0	0	9.0	0.00	0.00
02 Jul	2	7.5	0	0	15.0	0.00	0.00
10 Jul	4	7.5	7	7	30.0	0.23	0.23
12 Jul	2	4.5	9	9	9.0	1.00	1.00
21 Jul	6	2.0	7	7	12.0	0.58	0.58
24 Jul	2	5.0	7	7	10.0	0.70	0.70
31 Jul	2	5.0	0	0	10.0	0.00	0.00
31 Jul	1	6.0	5	0	6.0	0.83	0.00
06 Aug	4	5.5	5	5	22.0	0.23	0.23
06 Aug	4	5.5	5	5	22.0	0.23	0.23
20 Aug	3	9.0	38	9	27.0	1.41	0.33
20 Aug	4	6.0	40	15	24.0	1.67	0.63
20 Aug	2	3.0	10	2	6.0	1.67	0.33
21 Aug	4	2.0	20	4	8.0	2.50	0.50
21 Aug	2	5.5	21	6	11.0	1.91	0.55
21 Aug	3	1.0	0	0	3.0	0.00	0.00
Total	58	93.6	174	76	255.0	12.96	5.31
Mean		4.46				0.62	0.25

Growth of northern pike in the Dall River is faster than in other stocks measured to date in Alaska. Five-year old males from the Dall River averaged 612 mm in length, compared to 555, 560, 496, 505, and 448 mm for Old Lost Creek, Minto Flats, George Lake, Volkmar Lake, and T Lake, respectively. Similarly, five-year old females from the Dall River averaged 618 mm in length compared to 576, 587, 531, 541, and 527 mm for Old Lost Creek, Minto Flats, George Lake, Volkmar Lake, and T Lake, respectively. It is particularly noteworthy that growth rates of lake resident northern pike are considerably slower than for stocks with access to major river systems, where migratory prey species are presumably more abundant (Clark 1988; Clark et al. 1988; Clark and Gregory 1988; Peckham and Bernard 1987; Holmes and Burkholder 1988). However, mean length-at-age of northern pike from the Little Dall River is more similar to estimates observed in interior Alaska lake populations. While tag recapture results indicate that the Little Dall River and the Dall River are a single stock from the standpoint of interchange of individuals from one stream to the other, size and age composition of samples from the Dall River differ considerably from those taken in the Little Dall River. Samples from the Little Dall River indicate a higher proportion of smaller and younger northern pike.

Estimates of the theoretical length at age zero could not be made with the length based model used in 1989. While parameters of the growth model obtained in 1989 are similar to values reported in 1988 for the Dall River stock of northern pike, Francis (1988) cautions that age-length data are not directly comparable to length-based data. The reason is that growth rate at age (from length-age data) is a different form of growth information than growth rate at length (from age-length data and tagging). In the case of length-age models the theoretical maximum length, for example, means asymptotic mean length-at-age, and maximum length for tagging data.

Geographic Closure of the Dall River Northern Pike Population

The null hypothesis of equal mixing among drainages can be rejected, and geographic closure of the Dall River assumed at the 95% level of confidence, if 1,425 northern pike are without tags from other drainages. As sampling proceeded in 1989 it was clear that significant immigration of tagged fish from other areas had occurred. The northern pike population of the lower Dall River is considered to be an open one, with fish moving into and out of the stream.

Dall River Abundance Estimate

Study design and sampling targets to achieve an abundance estimate were at the outset predicated on harvest estimates of northern pike in the Dall River. Since there was no *a priori* information on the abundance of northern pike in this river, an approximate estimate was calculated in order to plan the study. Harvest estimates of northern pike from the Dall River in 1984 are based upon Sumida's (1988) estimate of the 1984 (the only year when harvest data are available) subsistence harvest for the community of Stevens Village, and from responses to the statewide sport fish harvest survey in that year (Mills 1985). The estimated subsistence harvest was 730 northern pike for 1984, but the proportion of the harvest taken from the Dall River is not known. It is

clear from Sumida (1988) that northern pike are taken on a year-around basis by local residents, using various gear types and from many different locations on the main Yukon River as well as on local tributaries and sloughs such as the Dall River. It is assumed that a significant proportion, but not all, of the harvest was from the Dall River. The accuracy of the 1984 harvest estimate of 1,750 northern pike in the sport fishery (Mills 1985) is suspect, since estimates are based upon very few responses. In no other year in which responses were received from this fishery was the harvest estimate of this magnitude. However, for the purpose of the experimental design, we assumed a maximum harvest estimate to determine whether such harvests could be within the range of sustained yield using 16% exploitation as a maximum rate.

Clearly, the estimate of 4,385 (SE = 313) northern pike for the Dall River is biased. While selectivity of marked versus unmarked fish on the basis of size does not appear to have occurred, unequal mixing of tagged fish from the upper to the lower Dall River is indicated by differences in the marked to unmarked ratio of northern pike captured in the lower river. All marked fish must have an equal probability of recapture, to obtain an unbiased abundance estimate for the entire river. Therefore immigrants recaptured in the lower Dall River in 1989 and northern pike originally tagged in the upper Dall River in 1988 and recaptured in 1989 are not included in the estimate. Our population estimate is therefore germane only to the lower river sub-population. It is apparent that fish normally resident in the Dall River drainage do not necessarily randomly mix in the lower Dall River in August. Strict territory defense and/or adherence to only one location by northern pike does not seem to have been the case either, from the evidence of tag returns on fish tagged outside the lower Dall River and recaptured there. The sub-population of northern pike that resides in the lower river contains individuals that move out of the Dall River and into the Yukon River, as well as those that have immigrated from other locations via the Yukon River.

The Petersen estimator is appropriate if either mortality or recruitment (but not both) occurs between events. Because our experiment was designed as a two year, two sampling experiment, both natural mortality and growth recruitment were expected to occur. We had planned to cull growth recruitment from the sample collected in 1989 using a non-parametric procedure described by Robson and Flick (1965). The abundance estimate has not been adjusted for growth recruitment since it is evident from the size composition of immigrants (Appendix A6) that large fish, as well as smaller ones immigrate to the Dall River, making it impossible to distinguish between this source of recruitment and growth recruitment. Because the population of northern pike in the Dall River experiences recruitment through movement and growth, the population estimate, germane to only the lower 18 km of the Dall River, is considered to be biased high. To achieve an estimate of the total Dall River northern pike population, it would be necessary to mark and recapture a larger number of individuals in upper river sections, and the estimate would then need to be stratified by area to counteract the effects of incomplete mixing.

ACKNOWLEDGEMENTS

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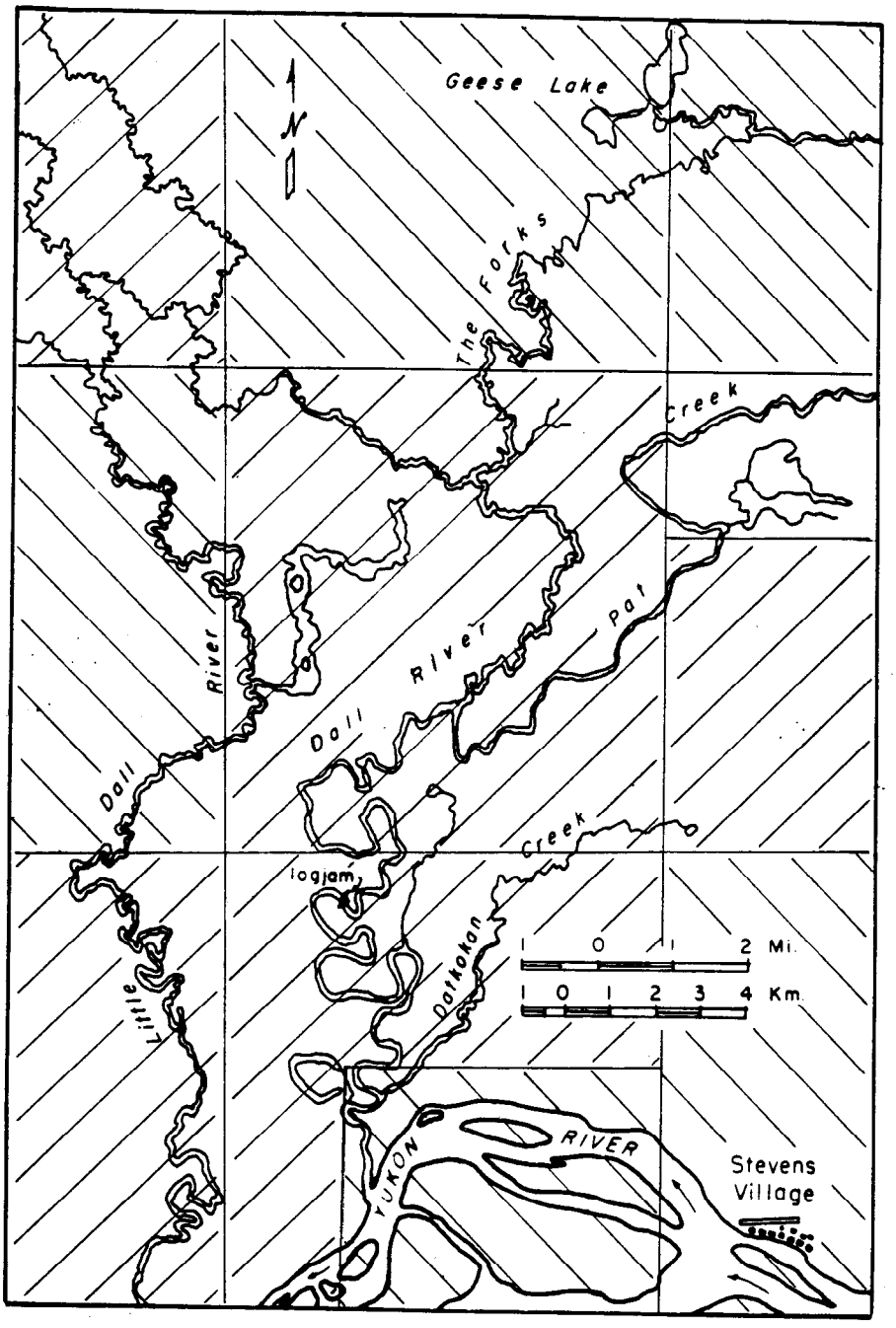
Appendix A



Regional or village corporation selected lands

Regional or village corporation conveyed lands (interim conveyance)

Public lands (refuge)

Appendix A1. Status of 1988 land ownership in townships near the Dall River. Individual allotments are not shown. Township borders are approximated.

Appendix A2. Age and length (mm) of northern pike sampled from streams near the Yukon River Haul Road Bridge, 1988 and 1989.

	Males			Females			Combined[a]		
		Length[b]			Length[b]			Length[b]	
Age	Sample Size	Mean	SE	Sample Size	Mean	SE	Sample Size	Mean	SE
Dall River 1988									
1	0	---	---	0	---	---	1	301	---
2	1	461	---	1	460	---	4	404	29
3	7	550	19	13	534	12	20	540	10
4	36	568	10	39	580	9	78	572	7
5	83	612	6	50	618	9	134	613	5
6	80	650	9	74	668	8	155	659	6
7	101	661	6	101	679	8	203	670	5
8	67	692	9	69	728	9	136	710	6
9	58	697	8	50	735	12	108	715	7
10	27	727	12	25	768	20	53	760	12
11	8	736	19	14	745	25	22	742	17
12	8	774	23	8	861	36	16	817	27
13	4	709	30	1	960	---	4	770	62
14	1	715	---	3	851	26	4	817	33
15	0	---	---	0	---	---	0	---	---
16	0	---	---	0	---	---	0	---	---
17	0	---	---	0	---	---	0	---	---
Total	481	647	---	448	683	---	938	669	---
Dall River 1989[b]									
1	---	---	---	---	---	---	3	297	21
2	---	---	---	---	---	---	27	329	5
3	---	---	---	---	---	---	50	419	6
4	---	---	---	---	---	---	37	496	5
5	---	---	---	---	---	---	114	572	4
6	---	---	---	---	---	---	213	632	3
7	---	---	---	---	---	---	218	700	3
8	---	---	---	---	---	---	96	762	6
9	---	---	---	---	---	---	27	828	13
10	---	---	---	---	---	---	8	910	36
11	---	---	---	---	---	---	1	950	---
Total	---	---	---	---	---	---	794	636	---

-continued-

Appendix A2. (page 2 of 3)

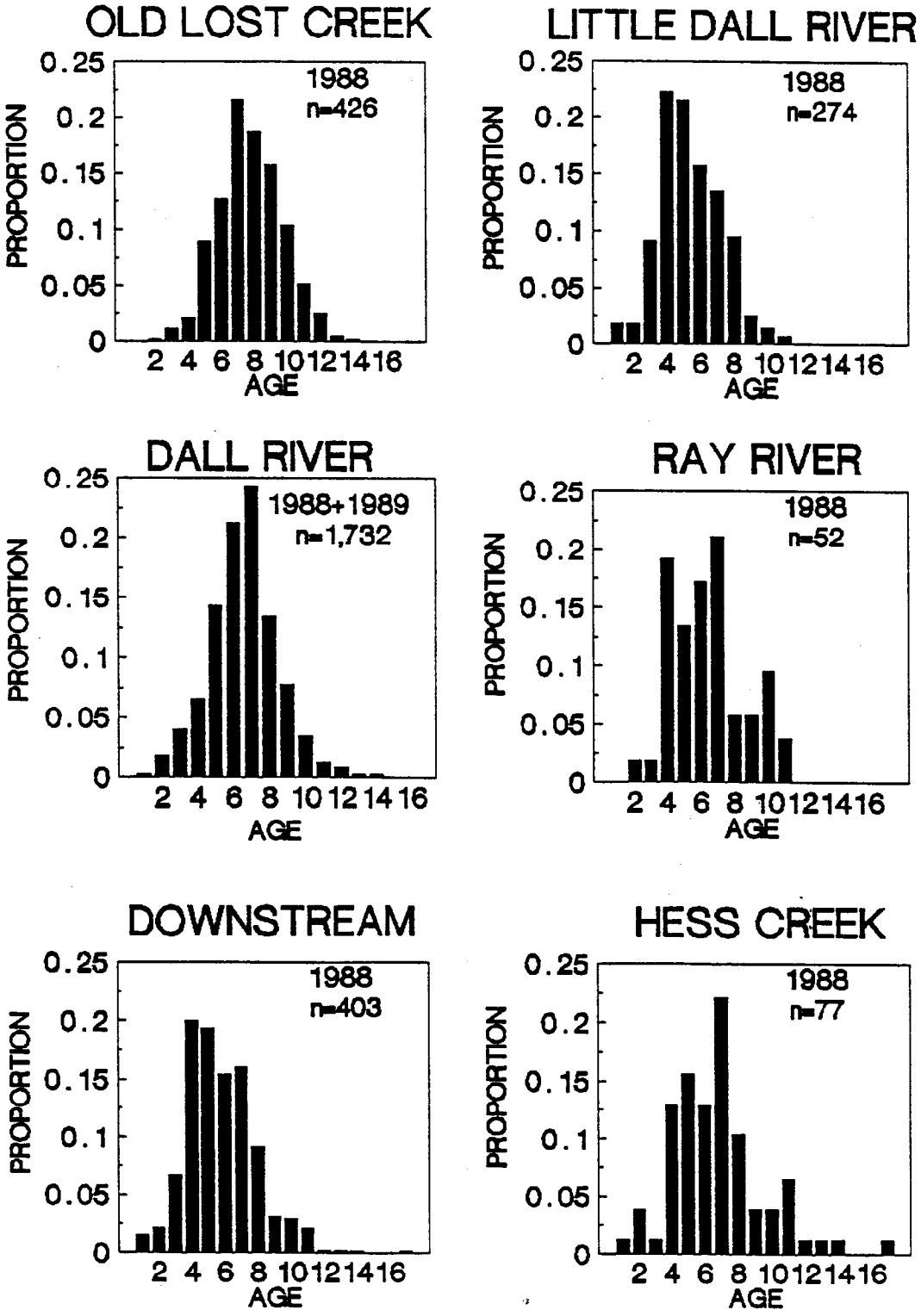
	Males			Females			Combined[a]		
		Length[b]			Length[b]			Length[b]	
Age	Sample Size	Mean	SE	Sample Size	Mean	SE	Sample Size	Mean	SE
Old Lost Creek 1988									
1	0	---	---	0	---	---	0	---	---
2	0	---	---	0	---	---	1	300	---
3	1	315	---	2	428	4	5	398	23
4	3	534	53	6	509	34	9	517	24
5	19	555	11	19	576	29	38	565	10
6	30	602	9	24	598	25	54	600	7
7	56	618	7	36	613	23	92	616	6
8	50	635	8	30	672	26	80	649	7
9	42	662	7	25	721	26	67	684	8
10	24	695	14	20	700	28	44	697	12
11	12	729	18	10	776	36	22	750	20
12	2	795	126	9	799	10	11	798	19
13	2	900	27	0	---	---	2	900	27
14	0	---	---	1	800	---	1	800	---
Total	241	637	---	182	655	---	426	643	---
Ray River 1988									
1	0	---	---	1	325	---	0	---	---
3	0	---	---	1	337	---	1	325	---
4	3	497	35	6	512	17	1	337	---
5	2	530	82	5	567	10	10	509	14
6	6	568	16	3	568	21	7	556	20
7	4	494	36	7	619	30	9	568	12
8	0	---	---	3	590	17	11	610	23
9	0	---	---	3	764	61	3	590	17
10	2	747	89	3	643	80	3	764	61
11	0	---	---	2	833	103	5	685	58
12	0	---	---	0	---	---	2	833	103
Total	17	555	---	34	596	---	52	589	---

- continued -

Appendix A2. (page 3 of 3)

Age	Males			Females			Combined[a]		
	Sample Size	Length[b] Mean	SE	Sample Size	Length[b] Mean	SE	Sample Size	Length[b] Mean	SE
Hess Creek 1988									
1	0	---	---	0	---	---	1	285	---
2	3	534	17	0	---	---	3	534	17
3	0	---	---	1	404	---	1	404	---
4	6	472	29	4	459	28	10	467	20
5	8	513	21	4	531	18	12	519	15
6	3	552	54	6	522	43	10	507	38
7	8	589	21	9	589	32	17	589	19
8	1	582	---	6	604	11	8	560	42
9	2	671	4	1	775	---	3	699	28
10	2	675	19	1	790	---	3	713	14
11	3	786	12	2	754	4	5	773	10
12	1	710	---	0	---	---	1	710	---
13	1	707	---	0	---	---	1	707	---
14	1	838	---	0	---	---	1	838	---
15	0	---	---	0	---	---	0	---	---
16	0	---	---	0	---	---	0	---	---
17	1	930	---	0	---	---	0	---	---
Total	40	593	---	34	573	---	77	572	---
Little Dall River 1988									
1	1	266	---	1	347	---	5	310	14
2	3	443	39	1	455	---	5	418	39
3	13	480	10	12	486	17	25	483	9
4	29	500	9	32	500	8	61	500	6
5	24	541	9	35	544	13	59	543	9
6	19	559	17	24	571	13	43	566	10
7	15	578	12	22	600	15	37	591	10
8	10	648	22	16	668	20	26	660	15
9	3	714	27	4	660	19	7	683	19
10	0	---	---	4	632	16	4	632	16
11	1	791	---	1	791	---	2	827	56
Total	118	543	---	152	561	---	274	550	---

[a] Includes fish of unknown sex.
[b] Length ranges are presented in Appendix A3.

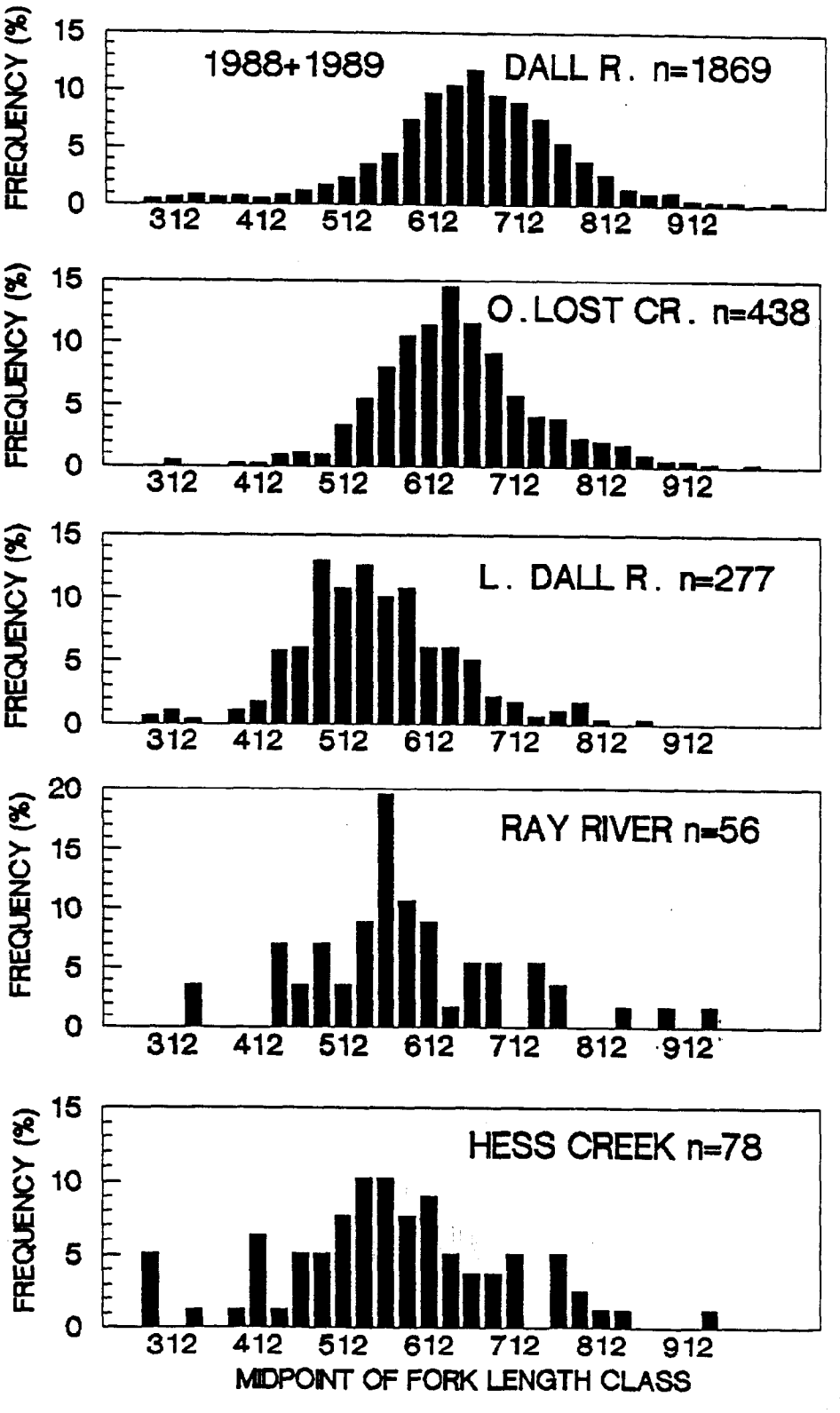


Appendix A3. Age proportions of northern pike captured in 1988 from stream in the vicinity of the Yukon River Haul Road Bridge. Downstream category includes Hess Creek, Ray River, and Little Dall River combined.

Appendix A4. Age and length composition of northern pike from the Dall River in 1988 and 1989.

Age	n	Length range	n	Length range	n	Length range	n	Length range
	1988 Females		1988 Males		1988 Combined sexes[a]		1989 Combined sexes[a]	
1	0	---	0	---	1	---	3	258--332
2	1	---	1	---	4	325--461	27	259--390
3	13	430--605	7	487--611	20	430--611	50	333--501
4	39	445--722	36	395--648	78	390--722	37	427--583
5	50	435--728	83	410--740	134	410--740	114	495--666
6	74	485--865	80	440--959	155	440--959	213	535--800
7	101	520--872	101	550--790	203	520--872	218	551--820
8	69	594--956	67	548--865	136	548--956	96	607--935
9	50	537--941	58	589--862	108	537--941	27	698--960
10	25	654--980	27	615--846	53	615--980	8	732-1,030
11	14	609--925	8	662--835	22	609--925	1	---
12	8	659-1,010	8	675--875	16	659-1,010	---	---
13	1	---	4	646--772	4	646--970	---	---
14	3	800--870	1	---	4	715--883	---	---
Tot	448	430-1,010	481	395--959	938	325-1,010	794	258-1,030

[a] Includes fish of unknown sex.



Appendix A5. Length frequency distribution of northern pike captured in 1988 in streams in the vicinity of the Yukon River Haul Road Bridge.

Appendix A6. Recaptures of northern pike in 1988 and 1989 outside streams of original tag application.

Tag Number	Tagging Location	Date Tagged	Date Recovered[a]	Recovery Location	1989 Length (mm)
93153	L. Dall R.	7/09/88	08/21/88	Dall R.	--
93251	L. Dall R.	7/12/88	08/23/88	Dall R.	--
94063	Dall R.	7/11/88	08/06/88	Hess Cr.	--
94695	Dall R.	8/18/88	09/02/88	L. Dall R.	--
94014	Dall R.	6/27/88	09/--/88	Jackson Sl	--
94299	Dall R.	6/24/88	09/--/88	Jackson Sl	--
94498	Dall R.	8/08/88	09/--/88	Jackson Sl	--
94530	Dall R.	8/10/88	09/--/88	Jackson Sl	--
94760	Dall R.	8/20/88	09/--/88	Jackson Sl	--
94865	Dall R.	8/22/88	09/--/88	Jackson Sl	--
94893	Dall R.	8/22/88	09/--/88	Jackson Sl	--
94894	Dall R.	8/22/88	11/--/88	Jackson Sl	--
93010	L. Dall R.	7/06/88	7/26/89	Dall R.	588
93013	L. Dall R.	7/06/88	7/23/89	Dall R.	664
93017	L. Dall R.	7/07/88	8/08/89	Dall R.	626
93018	L. Dall R.	7/07/88	8/20/89	Dall R.	600
93022	L. Dall R.	7/07/88	8/04/89	Dall R.	608
93062	L. Dall R.	7/08/88	8/20/89	Dall R.	540
93063	L. Dall R.	7/08/88	7/19/89	Dall R.	590
93073	L. Dall R.	7/09/88	8/22/89	Dall R.	577
93078	L. Dall R.	7/09/88	7/24/89	Dall R.	678
93079	L. Dall R.	7/09/88	8/06/89	Dall R.	648
93110	L. Dall R.	7/07/88	8/08/89	Dall R.	665
93115	L. Dall R.	7/07/88	8/09/89	Dall R.	652
93124	L. Dall R.	7/08/88	8/07/89	Dall R.	675
93128	L. Dall R.	7/08/88	8/13/89	Dall R.	606
93145	L. Dall R.	7/09/88	7/25/89	Dall R.	670
93196	L. Dall R.	7/12/88	8/11/89	Dall R.	600
93204	L. Dall R.	7/10/88	7/28/89	Dall R.	593
93218	L. Dall R.	7/11/88	7/19/89	Dall R.	773
93239	L. Dall R.	7/11/88	8/08/89	Dall R.	620
93244	L. Dall R.	7/12/88	8/18/89	Dall R.	660
93248	L. Dall R.	7/13/88	8/06/89	Dall R.	628
93282	Ray R.	8/03/88	8/07/89	Dall R.	760
93285	Ray R.	8/03/88	8/07/89	Dall R.	652
93324	Ray R.	8/05/88	7/25/89	Dall R.	655
93356	Ray R.	8/04/88	8/08/89	Dall R.	950
93370	Hess Cr.	6/26/88	8/08/89	Dall R.	742

[a] Dashes indicate day of capture unknown.

Appendix A7. Study area and land status description of streams included in the Haul Road northern pike study.

Hess Creek enters the Yukon River from the east at 65° 40′N, 149° 49′W approximately 48 km downstream from the Dalton Highway Bridge. Current velocity is slow in the lower reaches, becoming swifter approximately 3 km upstream from the mouth, where gravel bars and riffles begin to emerge. Good habitat for northern pike is limited to the lower 2 to 3 km of the stream. The Ray River enters the Yukon River from the north at 65° 53′N, 149° 48′W., approximately 4 km downstream from the Dalton Highway Bridge. The stream is slow moving in the lower reaches with two large sloughs near the mouth. Approximately 4 km upstream, the river shallows drastically. Navigability as well as the best northern pike habitat, is generally restricted to the lower 4 km. Hess Creek and Ray River were only sampled in 1988. The Little Dall River enters the Yukon River from the west at 65° 56′N, 149° 17′W, approximately 33 km upstream from the Dalton Highway Bridge. It is a slow, meandering stream throughout its drainage in the Yukon Flats, and drains the area between the Dall River and the Fort Hamlin Hills to the west.

Many lakes connect to the Little Dall River, and the drainage provides extensive habitat for whitefish *Coregonus sp* and northern pike.

Study Area

The Yukon River and its tributaries in the vicinity of the Dalton Highway (Figure 1) include an area which encompasses the drainages of Hess Creek, Ray River, Little Dall River, Dall River, Alfred Creek, and Old Lost Creek. The drainage interconnects with that of the Dall River approximately 70 km upstream from the mouth via two channels. The cross drainage allows the exchange of water between the two systems and the potential for interchange of fish populations at least during higher water stages. A log jam located approximately 26 km upstream, completely blocked the stream to boat travel in 1988 and no sampling was conducted above that point. The Little Dall River was not sampled in 1989.

The Dall River enters the Yukon River from the north at 66° 00′ 30"N, 149° 15′W, approximately 40 km upstream from the Dalton Highway Bridge. It is the largest of the streams sampled in this study. The river originates in the Kokrines-Hodzana highlands northwest of the Yukon River and drains an extensive area of the western Yukon Flats between the Little Dall River on the west and the Hodzana River on the east. Its drainage includes such named distributaries as Datkokan Creek, Pat Creek, The Forks[5], the West Fork, and many named and unnamed lakes (Figure 2). The Dall River watershed provides extensive habitat for northern pike and whitefish, and also supports other fish species including burbot *Lota lota*, and sheefish. Arctic grayling, chum

[5] "The Forks" is a separate branch of the Dall River that itself splits into an East and West Fork.

salmon *Oncorhynchus keta*, and chinook salmon[6] *O. tshawytscha*, occur in the upper reaches of the Dall River drainage. Netting in the Dall River was conducted in both 1988 and 1989.

Old Lost Creek enters the Yukon River from the east at 66°08'N, 148° 35'W, approximately 101 km upstream from the Dalton Highway Bridge, and approximately 50 km upstream from Stevens Village. It is a low-gradient stream that drains a series of small lakes between the Yukon River and the foothills of the White Mountains to the southeast and provides excellent habitat for northern pike and whitefish.

Land Status

Land surrounding the mouth of Hess Creek has received interim conveyance to private ownership from the Bureau of Land Management. From approximately 5 km upstream of the mouth of Hess Creek, lands surrounding the creek have been selected by the State of Alaska. The status of lands surrounding the mouth of Ray River is more complicated. With the exception of the downstream corner of the mouth of the river, the majority of the land in the immediate area on both sides of the Yukon River have been state selected. Some individual and village selections are located just upstream of the mouth. As of this writing, no special landowner restrictions have been announced on any of the selected or conveyed parcels near the mouths of the two streams.

A large fraction of the land within the Little Dall and Dall River drainages have been selected for transfer to native corporation ownership, both by the regional Doyon Corporation, as well as by Dinyee, the local Stevens Village corporation. In addition, several individual land allotments have been conveyed, many of which are located along the Dall and Little Dall rivers. Many larger land blocks have been conveyed to corporate ownership. An approximate portrayal of the larger land selections and ownership status is presented in Appendix A1. The distinction between selected and conveyed lands is important since selected lands are still in public domain, while the conveyed lands are privately owned and may be subject to land-owner restrictions. Dinyee Corporation has publicized the status of lands in the vicinity of Stevens Village as well as restrictions upon public use of those lands owned by the corporation and its shareholders. Almost the entire area surrounding Old Lost Creek has received interim conveyance to the Doyon Corporation.

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[6] A single male chinook salmon of approximately 3 kg was captured in the Dall River 16 km from the mouth on July 20, 1989 in a variable mesh gill net.